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NOTES ON COKING COAL AREAS OF THE USSR

Donets Basin

Table 1: Coal Reserves (percentages as of 1935)

Types of Coal	Percent of Reserves	Percent of Coal Mined
PZh, PS, and K	26.0	44.0
G and D	22.2	15.0
T	19.2	5.0
A	32.6	35.0

Coal Reserves estimated at 88 billion tons (as of 1937)

PZh = parovichno-zhirnyy = steam-fat

PS = parovichno-spekayushchiysya = steam-coking

K = koksovyy = coking

G = gasovyy = gas

D = dlinnoplamenyy = long flame

T = toshchiy = lean

A = antratsit = anthracite

Table 2: Prospects of mining different types of coal in the Donbass

(in 1,000 tons)

Type of Coal	Actual Mining for 1935	Possible mining by year and type 1938	1950	1944
S	29,594	47,983	57,655	56,250
D	2,815	1,745	5,793	4,950
G	7,537	12,281	13,236	12,526
T	2,791	3,607	4,400	4,110
A	24,034	38,084	41,356	36,806

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Table 3: Coking coal consumption in 1935 (in thousands of tons)

Use of type of Coal	F	PZh	PZh (PK)	K	K (PK)	KS	PS	PS (PK)	G
Coking	1498.5	6128.7	89.9	5261.7	10.3	629.4	3425.7	9.1	347.9
Railroad transport	--	2166.8	233.9	216.9	31.5	--	2332.9	34.1	3192.8
Electric power	941.5	1844.5	856.7	68.4	191.9	3.5	405.3	244.7	3983.6
Total	2440.0	10140.0	1180.5	5547.0	233.7	632.9	6163.9	287.9	7524.3

Table 4: Distribution of gas coal in Donbass regions

Total Geological Reserves (1,000 tons)

Region	seam up to 50 cm	seam 50-70 cm	seam more than 70 cm	industrial	Total
Lisichansk	33,120	486,298	1,184,425	1,670,723	1,703,843
Mar'yevskiy	118,531	1,089,085	934,103	2,023,188	2,141,719
Almaznaya	62,434	694,282	407,882	1,102,164	1,164,598
Tsentral'nyy	109,772	455,514	304,052	759,566	869,338
Staro-Makeyevka	463,795	1,154,832	1,910,998	3,065,825	3,529,620
Grishinskiy (east)	647,085	1,483,585	536,944	2,020,529	2,667,614
Grishinskiy (west)	--	--	--	--	8,500,000

An analysis of data on geological coal reserves by type indicates that there is a greater amount of gas coal than any other. Table 1 showes reserves of gas coal to be almost as much as those of PZh, PS, and K coal together. Gas coals are mined in small amounts in spite of the fact that they show good indexes in the yield of chemical by-products, have a low sulphur content and large reserves. Mining of gas coal planned for 1944 was even less than in 1940 and about one fifth of planned mining of PZh, K and PS coking coals together.

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Table 3 shows for what purposes coking coal is utilized. Although gas coal yields a high amount of chemical by-products in coking, only a relatively small amount of it is utilized. Most of this is used for electric power and railroads.

Table 4 indicates the distribution of gas coal deposits in the Donbass and shows the large proportion of this type of coal in the Grishinskiy deposits. This is now called the Krasnoarmeyskoye deposit.

Up to 1938 there was no intensive exploration, planning, or sinking of new gas coal shafts because it was only in 1938 that it was shown by P Lysenko that gas coal yields excellent metallurgical coke.

Kuznetsk Basin

Table 5: Average analyses of Kuzbass coals

	Percent Content						
Type of Coal	Volatile Matter	Carbon	Hydrogen	Nitrogen	Sulphur	Calorific value	Characteristic of coke in crucible test
D and G	37-43	78-86	5.8-6.1	2.3-2.9	0.3-1.2	7800-8350	from non-fusing to fusing and swelling
PZh	24-37	84-88	5.3-6.2	2.2-3.4	0.4-0.9	8200-8600	fusing, swelling
K	18-25	85-90	4.2-5.5	1.65-2.9	0.3-0.8	8300-8600	fusing compactly or swelling
Admixture of PS and poor K	13-28	87-91	4.0-6.0	1.6-2.5	0.35-0.8	8350-8700	caking, fusing compactly
T	9.0 12.5	88-92	3.5-4.4	1.6-2.5	0.45-1.1	8400-8600	noncaking

Coal reserves in Kuzbass were estimated at 450 billion tons as of 1949

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The Kuzbass contains coals of all types, including the largest deposits of high-quality coking coal. In 1913, 795,000 tons of coal were mined in the Kuzbass, in 1936, 17 million tons, and since 1936 the mining of coking coal in particular has constantly increased. The Kuzbass is the chief source of coking coal types most difficult to obtain. The geology of the basin and its mineral wealth have been intensively studied during the past 10-12 years. The quality of coal in its regions has been inadequately studied not only for deposits at a distance from industrial centers but also for those near them. Thus mines were constructed to the southeast, in Leninskiy Rayon, but the tremendous coal deposits discovered already in 1929-1930 lie considerably nearer, to the northwest, in the Yegozovskiy section.

The Zhuravskiy group is the only one of the numerous seams studied which has already been exploited for a long time. Some seams (seam 4 and others) possibly of interest to metallurgy have not been studied. Also the Plotinkovskiy coal deposits have not been studied. The coal of the Yerunikovskiy strata is petrographically of one type, and is a good coking coal. The coal of the seams of the Balakhonskiy stratum belong to different petrographic types entering into the seam in different relations. The quality of the coal of the various seams of the Balakhonskiy stratum depends on the metamorphism and on the petrographic condition. During the past ten years rich deposits of coal have been discovered in the Tom'-Usinskiy and Mrasskiy areas.

/Here follows a summary of article "Coking Coal Industry of the Kuzbass and Possibility of Expanding It" by V. I. Yavorskiy, most of which has been exploited in report No 00-W-8039/50; the remaining information appears elsewhere therein. /

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(PZh coal is a type of coal which can be used for metallurgical coke if 20-30 percent lean, non-caking coal is added to it. If PZh coal is heated to 1,000 degrees in the absence of air, 26-32 percent of the volatile matter will be lost. Type K coal loses 18-26 percent of the volatile matter. Gas coal, type G, loses 32-38 percent of its volatile matter when roasted. Long-flame coal, type D, when heated to 1,000 degrees in the absence of air, loses more than 38 percent of its volatile matter).

The Kiselevsko-Prokop'yevskiy region has been pretty adequately studied and coking coal reserves showing possibilities for development are to be found there. This region is the richest in both the quantity and quality and the best coking coal is mined here. In the postwar years mining of coking coal, in particular, K and PZh coal has doubled. According to Yavorskiy K and PZh coking coal reserves in the remaining mines of Kuzbassugol' Combine amount to a total of 27.7 percent, nevertheless during the past 7 years 56-57 percent of all mining was concentrated on these two types. Yavorskiy shows that such a disproportion has forced mining of coking coal to be carried on at lower levels when there are still unworked supplies in higher levels.

Academicians Terpigorev and Buchnev write: The narrow range of coal types temporarily fixed during the war cannot be maintained at the present time and must be considerably expanded. This was shown conclusively by experiments and industrial research work of the Academy of Sciences USSR (experiments of Academicians Pavlov and Chipeyevskiy), Kharkov Coal-Chemical Institute, the Eastern Coal-Chemical Institute and in recent years by the work of VUGI (All-Union Coal Institute) and plant experiments of Kuznetsk Metallurgical Combine and Kemerovo Coke-Chemical Plant. Unfortunately the metallurgical industry is not making use of this work. Procedure adopted of

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necessity by the coal industry during the war continue to be adhered to also in the postwar period. However, it is necessary to increase the number of types of coal for coking by utilizing types G and PS, large amounts of which are to be found in the upper levels which are being worked. This will permit rise in labor productivity, an increase in coal mining, and alleviation of the serious situation of coking coal in the Kuzbass.

The possibility of finding coking coal in Kemerovskiy Rayon has not been fully proved. Detailed exploration is now being carried on in the Biryulinskiy deposit along the Kedrovka-Latyshi line and in the deposits of the Glushinskaya Syncline (Mul'da). It is also possible that coking coal will be found in the western and northern walls of the Kedrovka brachysyncline, in the northern part of Kemerovskiy Rayon from the settlement of Glushinskiy to the settlement of Tizovka.

Yavorskiy writes PZh coal and highly fusing G coal are extremely important for the coking industry of the Kuzbass. Only with maximum utilization of this coal in coking charges can supplies of raw materials for the coking industry be considered very significant. It must be added that metallurgists too are inclined to acknowledge the necessity of a maximum amount of gas coal in coking charges.

It is possible the PZh coal area may be extended in the region of the Osinovskiy deposit. The discovery of PZh and G coals north of the Baydeyevskiy deposit is more probable.

The quality of the coal in the Yegozovskiy section in Leninsk-Kuznetskiy Rayon has not been studied. It is necessary to extend exploratory survey work to the northwest of the Cherinskiy and Belovskiy Synclines. The region on the left bank of the Uskat which is rich in coal deposits is of interest in the search for both PZh and G

coals. The Yerunakovskiy region, on the left bank of the Tom'; from the Yerunakovskiy deposit proper to the Bab'iy Kamen', a distance of 40 km, is outstanding for richness, diversity, and accessibility of exploitation. The seams of coal can at first be worked by drifts (shtol'nyami) or in part by open-pit mining. The drift resources are very great. Among them are undoubtedly seams containing coal of the PZh, G, and D types. At present no study has been made of the Balakhonskiy coal bed on the right bank of the Tom' and to the northwest of the Krapivinskiy Boss.

Karaganda Basin

Reserves estimated at 52 billion tons as of 1937.

The Karaganda Coal Basin is the third large coal basin of the USSR. This basin has a considerable supply of coking coal and it is the source of coal supply for a number of large plants of the ferrous and nonferrous metallurgical industry in Kazakhstan and the Urals.

Chelyabinsk Basin

Reserves estimated at 2 billion tons as of 1949.

This basin is an important power base for the Urals. At present it is being changed into a powerful coal-metallurgical base with a number of large, enterprises, located at a distance of more than 100 km from the coal field.

Pechora Basin

No figures for reserves.

This basin contains all types of coal including coking coal. The resources of the basin are several times greater than those of the Donbass. At present the basin is supplying coal to a number of enterprises and transport in the northwest regions of the USSR. In the future the Pechora coal basin will be the chief supply base of the northwestern metallurgical industry and will satisfy the requirements of industry of the northern section of the Urals.

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Caucasus

No figures for reserves.

Tkvarcheli and Tkibuli coal is suitable for coking.

Central Asia

Reserves estimated at 19 billion tons as of 1937.

Rich deposits of caking (coking) coal have been discovered and explored in east Fergana, Uzbek SSR (Tuyuk, Beshterek deposits among others).

Kizel Basin

Reserves estimated at 3.4 billion tons as of 1949

A large electric power plant has been constructed in Gubakha which utilizes Kizel coal as fuel. The Berezniki and Solikamsk combines, large industrial enterprises of the first two Five-Year Plans, also use this fuel.

Table 6

Coal Plants	Ash content of run-of mine coal	Fraction of specific weight < 1.4		Fraction of specific weight < 1.5	
		output in %	ash in %	output in %	ash in %
Coal Plants of Kuzbass	10.9	78.5	4.1	88.2	5.2
Southern Coal Plants Of Glavkoks (Main Administration of Coke)	20.9	65.0	5.1	71.5	6.1
Coal Plants of Ministry of the Coal Industry in Donbass	24.9	55.5	6.0	65.4	7.0
Karaganda TsOF (Central Concentration Plant)	19.8	67.7	8.1	79.9	10.3
Gubakha Coal Plant	22.4	51.7	8.8	67.3	11.3
Tkvarcheli Central Concentration Plant	43.7	26.7	10.1	38.1	13.5

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This table gives the results of concentrating coal of the USSR which goes into coking. Kuznetsk coal gave the best results. Donets coal concentrated in the plants of the Main Administration of Coke of the Ministry of Ferrous and Nonferrous Metallurgy and of the Ministry of the Coal Industry came next. Karaganda coal is concentrated in the Karaganda TsOF, Kizel coal in the Gubakha Plant, and Tkvarcheli coal in Tkvarcheli TsOF.

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NOTES ON METALLURGICAL FLUXES OF THE USSR

The chief fluxes in the USSR are limestones. Some phosphoritic limestone and silica-free limestones are located both in the Kuzbass region and in the Urals. Large deposits of limestone are located in the southern USSR in the Crimea (at Balaklava) and in the Yelenovka Deposit, an analysis of which is given in Table No 14-a. Transport of limestone fluxes to blast furnaces is not a difficult problem, since pure limestones occur in all industrial regions of the USSR. Much limestone occurs in the eastern part of the USSR in particular. Plants in the South, that is, in the Donbass and the Dnepr region, use the limestone from the Yelenovka deposit. Geological reserves of this deposit total 85 million tons. In the future, the Dnepr, Axov, and Kerch' plants will be supplied with limestone from the Crimean deposit which are also free of such harmful elements as silica and alumina (no higher than 2 percent) and phosphorus (0.01-0.02 percent). The Ural plants get their limestone solely from nearby limestone deposits. For example, the Magnitogorsk Metallurgical Plant is supplied from the Agapovka Deposit, which contains 3-4 percent magnesia, no more than 2 percent SiO_2 and Al_2O_3, and approximately 0.02 percent phosphorus. The Kuznetsk Plant is also supplied with a high-quality limestone containing no more than 2 percent of insoluble substances (SiO_2 and Al_2O_3). These supplies however, must be shipped from the distant Gur'yev Deposit. Dolomite fluxes are not used in the USSR since they are rare and their cost is higher than limestone fluxes.

Acid fluxes are used in the USSR on an extremely insignificant scale and only by those Ural blast furnaces which reprocess magnetite containing waste rock with a high alumina content. Hearth cinder and lean iron ore, in which the proportion of silica to alumina is relatively high, are the chief acid fluxes.

TABLE 14-a

Analysis of the Limestones of the Yelenovka Deposit (in percent)

	Number of the Zone (extent of zone in parentheses)						
	2 (28 m)	3 (32 m)	4 (32 m)	6 (37 m)	7 (7.5 m)	8 (17 m)	4 (24 m)
SiO_2	2.00	3.40	0.62	0.55	3.22	0.97	2.75
Al_2O_3	0.09	0.20	0.16	0.15	0.16	0.14	0.99
Fe_2O_3	0.27	0.27	0.22	0.20	0.22	0.17	1.12
CaO	53.50	53.42	54.26	54.85	52.93	54.60	50.77
MgO	0.70	0.78	0.66	0.50	0.50	0.54	1.35
P_2O_5	0.01	0.033	0.018	0.026	0.028	0.025	0.010
SO_3	0.24	0.28	0.20	0.19	0.13	0.35	0.50
Losses in Roasting	42.85	41.96	43.46	43.57	42.10	43.51	42.85
Total	99.66	100.34	99.60	100.04	99.29	100.31	99.55
Fe	0.19	0.19	0.15	0.14	0.15	0.12	0.78
P	0.004	0.0144	0.0078	0.011	0.012	0.01	0.044
S	0.096	0.112	0.080	0.076	0.052	0.140	0.200

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NOTES ON METALLURGICAL COKE OF THE USSR

The metallurgical industry of the Soviet Union for the most part is situated in regions where there are deposits of coking coal. Nearly 30 percent of the metallurgical industry is located in the European part of the USSR and in the Donets Basin of the Ukraine. Approximately 30 percent of the total number of metallurgical plants are located in the eastern part of the Union, that is, in the Kuzbass in Western Siberia. A small group of plants are located near iron ore deposits. These include the plants near the Kerch' and Krivoy Rog deposits in the South and the Tagil, Chelyabinsk, and other plants of the Urals in the Eastern USSR Finally, there is a third small group of plants located near sea ports into which come both iron ore and coal. These plants include the "Azovstal'" Plant in Mariupol' [now Zhdanov], the Zaporozh'ye, Dnepropetrovsk, and Dneprodzerzhinsk plants.

Table No 15 (cf. Pavlov, Metallurgiya chuguna, p. 35) shows the smelting of pig iron in Tsarist Russia and the USSR, and for comparison, also gives figures on pig iron smelting in other countries. Table No 16 (Ibid, p. 39) gives the smelting of pig iron according to type.

In the USSR, all low-phosphorous pig iron is Bessemer iron. Almost all pig iron in the USSR, as in Germany, France, England, and the US, is smelted with coal coke. Only two small blast-furnaces in the USSR -- at the Gur'yevsk Plant in Siberia and the Verkhne-Turinskiy Plant in the Urals -- use coal in smelting pig iron. The coal is shipped from the Kuzbass (the Volkovskiy and Moshchnyy seams). Smelting with charcoal is done only in the Urals and on a very small scale there. Nomore than 15 of the 28 furnaces in the Ural use charcoal, and all of these furnaces are of small

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size. No more than 25-30 percent of the total pig iron smelted in the USSR is smelted with charcoal. Thirty-two new blast furnaces (with 828 to 1,300 cubic meter capacity) were built in the period from 1926 to 1940. Smelting of pig iron in these furnaces amounted to 75 percent of the total quantity of USSR pig iron production.

Table No 17 (Ibid, p. 54) gives the performance of coke blast furnaces of the Soviet Union. A distinguishing feature in the operation of the blast furnaces in the South (Donbass, Dnepropetrovsk, Dneprodzerzhinsk, Zaporozh'ye, Mariupol' and Kerch' plants) is the high sulphur content of the coke and the relatively high content of fines (dust) in the iron ore. A large part of this type of ore which is shipped to southern plants does not undergo preliminary sintering and is used in the blast furnaces without preparation. The coal from which coke is obtained undergoes preliminary concentration by washing in jigging machines, making possible a great reduction in the ash content of the coal (on an average of from 16-22 percent down to 8-9 percent). However, reduction of the sulphur content of the coal is insignificant, since nearly 70 percent of the sulphur is in the form of organic compounds. Not all of the pyritic sulphur is precipitated from the coal when it is washed, since part of the coal contains disseminated particles of sulphuric pyrite. The coke obtained in the southern part of the USSR (Donbass) contains on the average of 1½ to 2 times more sulphur than does the coke of the US, Germany, and England.

Table 18 (Ibid) shows the operation of blast furnaces of the three Ural plants which use charcoal. The blast furnaces of the Asha and Satka plants used ores from the Bakal deposit. However, siderite and magnesium waste rock are used in the charge at the Satka Plant. The blast furnace of the Serov Plant operated on iron ore from a local deposit

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These ores are more difficult to reduce than the Bakal ores. The charcoal of the Northern Ural is poorer and more porous than the southern Ural charcoal. The pig iron obtained is low-phosphorus open-hearth pig, but with a chrome content of nearly 0.16 percent.

In considering the raw material and fuel base of USSR metallurgical plants, I shall refer to my book Rasshireniye syr'yevoy bazy koksokhimicheskoy promyshlennosti na osnove novykh predstavleniy o koksuyemosti ugley (P. D. Lysenko, "Expansion of the Raw Material Base of the Coke-Chemical Industry on the Basis of New Ideas on the Coking Capacity of Coals," UKhIN, Kharkov, 1940). Later, I shall deal in more detail with a criticism of old methods of determining the coking capacity of coals and shall describe the new method by which I was able, in my work in the USSR, to solve the extremely important problem of extensive expansion of the coal base of the coke-chemical industry. I believe that this work will also be of importance to the US.

Metallurgical coke until 1938 was roasted in coke-chemical plants of the South and East from charges consisting primarily of "PZh" (steam-fat), "K" (coking), and "PS" (steam-clinkering) coals. The proportion of gas coals used in the charges was extremely small, on the average of 2-3 percent. As is known, the gas coals of the Donbass in relation to all coking coals (types "PZh", "K", and "PS") have a low sulphur content and in coking, yield a high residue of chemical products, particularly crude benzene and tars with a relatively high content of phenols. Gas coals yield many necessery chemical products as wastes, while the low content of sulphur in these coals makes for a high-quality coke.

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TABLE 15

Smelting of Pig Iron (in thousands of tons)

	Country				
Year	Great Britain	USA	Germany	France	Tsarist Russia and USSR
1870	6,059	1,690	1,262	1,178	359
1890	8,031	9,350	4,100	1,962	927
1906	10,346	25,710	10,833	3,314	2,719
1913	10,425	37,463	16,764	5,207	4,635
1929	7,711	43,296	13,239	10,364	4,320
1932	3,631	8,922	3,932	5,537	6,173
1934	6,065	16,968	8,714	6,151	10,410
1936	7,809	37,173	15,303	6,237	14,393
1938	6,871	19,467	18,517	6,859	14,651
1939	8,260	32,110	20,145	7,951	14,519
1940	8,453	42,475	21,133	4,623	14,902

TABLE 16

Smelting of Pig Ironby Type (in percent)

Country	Foundry	Low-Phosphorous	Thomas	Open-hearth	Puddling	Miscellaneous and Special
Great Britain	18[illegible]	12	--	65	2	3
USA	8	16	--	67	--	9
Germany	7	5	66	19	--	3
France	13	--	80	--(1)	3	4
USSR	20	9.5	2.5	66	--	2
All five countries, including Belgium and Luxembourg	10.5	10.5	24	50	0.5	4.5

(1). Shown together with puddling and miscellaneous

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The use of this coke in the blast furnace should result in a high quality pig iron and should reduce the consumption of coke in smelting each batch of pig. Therefore, it is necessary to consider the reasons for which gas coals are not being used for coking.

If we consider the geological reserves of coals by type, it appears that gas coals represent the greatest proportion of all coals. Moreover, as is shown in Table No 1 (cf. Table No 1 in the section "Raw Material Base of Coals") the reserves of gas coals are almost equal to the reserves of all coking coals of the "PZh," "K," and "PS" types. Table No 1 also shows that these coals are mined in a volume which does not correspond at all to their reserves. That is, the volume of "PZh," "K," and "PS" coals mined is considerably higher than their reserves warrant. The opposite is true of gas coals. Thus, gas coals, with their high yield of chemical by-products and their low content of sulphur, are mined in insignificant quantity, despite their tremendous reserves. Why is this so? It is possible that the mining of gas coals on such an insignificant scale has been dictated by conditions -- by the presence of old low-speed coking furnaces. Table No 2 (cf. section "Raw Material Base of Coal") shows the prospects for mining of coals by type and shows that the disproportion in the mining of "PZh," "K," "PS," and "G" (gas) remains the same. The mining of gas coal planned for 1940 was even less than in 1940 and almost five times less than the volume planned of "PZh," "K", and "PS" to be mined. Despite the fact that the slow-speed furnaces are being replaced by high-speed furnaces and that most of the coke is now being roasted in the latter, the mining of high-quality gas coals, both now and in the foreseeable future, is insignificant in relation to low-quality (from a technological analysis) coals. Why? Table No 3 (cf. Section "Raw Material Base of Coal) shows the purposes for which coking coals are consumed and also

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shows that gas coals, which are mined on a limited scale, are used in only insignificant quantities for coking, most of them being used for power and railroad purposes. Why is it that gas coals, which yield a high output of crude benzene as a result of coking, are not used for coking but rather for power needs? Perhaps the mining of gas coal is held back because the reserves of gas coal are dispersed throughout the entire Donbass and construction of mines would be unprofitable. Table No 4 (cf. Section "Raw Material Base of Coal") shows the regional distribution of gas coals in the Donbass. More than half of the reserves of gas coals are concentrated in the Krasnoarmeysk Mine Administration, indicating that these coals could be mined easily. What is the reason for the lack of intensive prospecting, planning, and building of new gas coal mines? In order to discover the real reason for the low output of gas coal and its slight use in coking, I shall explain the coking capacity of coking coals and of gas coal, in particular.

/Author refutes theories of L. M. Sapozhnikov and G. L. Stadnikov that gas coals are not suitable for obtaining metallurgical coke, presenting his own theory that gas coals have a high coking capacity. He describes successful plant tests of his theory which were made prior to 1941 and which are presented in his book "Expansion of the Raw Material Base of the Coke-Chemical Industry on the Basis of New Ideas on the Coking Capacity of Coals."/

After these tests were made, the possibility and necessity of obtaining coke from charges having a high content of gas coals were finally established. The coke-chemical plants in the South began to consume considerable quantities of gas coals. Plans for the expansion of mining in the Donbass were revised with a view toward increasing construction of gas coal mines.

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In 1940, similar tests were made in the East at the Magnitogorsk and Stalinsk coke-chemical plants and showed again that good metallurgical coke could be obtained from gas coals. Just prior to the war, in 1940-41, the general feeling prevailed that the problem of gas coals had finally been solved and that the raw material base for coke-chemical and metallurgical fuels had been expanded.

When the war began and it became known in the Soviet Union that I had gone over to the Germans, it was found necessary to eliminate my scientific work from industrial practice, which also meant the discarding of gas coals as a base for metallurgical coke. It was not clear how this could be accomplished in the East, where the coke-chemical and metallurgical industries were set up during the war, since 70 percent of all coking coals in the East are gas coals. Data given in one article indicate how this was accomplished and show the impossibility of proceeding further in eliminating gas coals from industry. V. I. Yavorskiy in the article "Koksuyushchiyesya ugli Kuzbassa i vozmozhnoye ikh rasprostraneniye" ("Coking Coals of the Kuzbass and Their Potential Expansion") in the periodical Ugol', No 5, 1949, reports that during the war years, the mining of coal for coking, particularly types "K" and "PZh," increased 100 percent. Yavorskiy also states that the reserves of coking coal of these two types in the [redacted] profitable reserves of the operating mines of the "Kuzbassugol'" Combine totaled 27.7 percent, while mining of these coals in the past 7 years has totaled 56-57 percent of the total output. Yavorskiy states that "such disproportion has made it necessary to convert to mining coking coals in the lower levels, while unworked reserves of power coals remain on the upper levels, and to conduct operations on the 2d, 3d and 4th levels."

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Academicians Terpigorev and Buchnev write, "The narrow limits, established temporarily during the war years, as to type of coking coals cannot be adhered to at present and must be considerably extended. This fact has been shown by exhaustive research and industrial tests made by the Kharkov Coal Chemical Institute...Unfortunately, the metallurgical industry is not making use of this work. This has led to the fact that the mining methods, of necessity adopted during the war by the coal industry, continue to be preserved even now in the postwar period and have been given particular emphasis in recent years. It is necessary to extend the limit on types of coal to be mined for coking purposes, in particular to expand the mining of types "G" and "PS", substantial reserves of which occur in the upper and working levels." The authors proceed even further to say, "This will help to increase labor productivity and coal output and will eliminate the strained condition in relation to coking coals which is being created in the Kuzbass."

In conclusion, I shall give excerpts from the report of Tevosyan, Minister of Ferrous Metallurgy, on the planned expansion of ferrous metallurgy in the Postwar Five-Year Plan. The report was given on 18 March 1946 in a session of the Supreme Soviet.

"During the war, new metallurgical plants were built in the East and the capacity of existing metallurgical shops was expanded with the utilization of equipment evacuated from the South. During the war years, the following new plants were built and put into operation: first section of the Chelyabinsk Metallurgical, Chelyabinsk Pipe-Rolling, Chebarkul', Aktyubinsk Ferroalloy, Novosibirskiy Kuznetsk Ferroalloy [sic], Magnitogorsk Calibration, Magnitogorsk Metal Products and many other plants.

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"Altogether, during the war, the following equipment was built and put into operation in the eastern plants of the "Narkomchermet" (Peoples' Commissariat of Ferrous Metallurgy): 10 blast furnaces, 29 openhearth furnaces, 16 electric furnaces, 2 Bessemer converters, 15 rolling mills, and 13 coke batteries.

"Production of metal in the East increased as follows during the war over the prewar (1940) level: 58 percent for pig iron, 56 percent for steel, 57 percent for rolled metal, 430 percent for iron pipe, and 104 percent for coke.

"Productivity of plants of "Narkomchermet" as planned for 1950 is as follows, as compared with 1940:

	1950 Planned Productivity (in tons)	As compared with 1940 (in percent)
Pig iron	19,100,000	132
Rolled metal	15,600,000	141
Coke	30,000,000	143
Iron ore	40,000,000	134
Iron pipe	1,460,000	166
Chamotte	255,000,000	164
Dinas brick	950,000,000	179

"The role of eastern metallurgy in the production of metal under "Narkomchermet" is increasing considerably and in 1950 will be 44 percent for pig iron as compared with 29 percent in 1940, 51 percent for steel as compared with 34 percent in 1940, and 51 percent for rolled metal as compared with 33 percent in 1940.

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"The Five-Year Plan provides for the investment of 26,940,000,000 rubles in ferrous metallurgy. During this time (1946-1950) the following equipment will be built, restored, and put into operation in plants of "Narkomchermet": 44 blast furnaces, 118 open-hearth furnaces, 31 electric furnaces, 15 converters, 91 rolling mills, and 65 coke batteries."

All specialists know that the electric furnace in the metallurgical industry is used relatively extensively only in those countries which are poor in coking coals but have much cheap hydroelectric power. Tevosyan's statement on the achievement of the USSR in building electric furnaces indicates the technical backwardness of the Soviet coke-chemical industry. Despite the fact that the USSR has tremendous reserves of good coking coals (gas), Soviet specialists have not been able to obtain for industry a sufficient quantity of metallurgical coke and, in particular of special (low-sulphur and low-ash) coke from these coals.

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